DOCUMENT RESUME

ED 297 157 CE 050 674

AUTHOR Hollenbeck, Kevin
TITLE Education, Training, and Employment Outcomes: Analysis of a National Survey of Employers. Final Technical Report.
INSTITUTION Ohio State Univ., Columbus. National Center for Research in Vocational Education.
SPONS AGENCY National Inst. of Education (ED), Washington, DC.
PUB DATE Nov 84
GRANT NIE-G-83-0005; P-2
NOTE 43p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Dismissal (Personnel); Economic Development; Education Work Relationship; *Employment Patterns; *Job Training; *Labor Market; *Models; National Surveys; *Outcomes of Education; *Promotion (Occupational)
IDENTIFIERS Employer Surveys

ABSTRACT

A study examined the effect of education and training on the economy and on employment outcomes. Data collected during a 1982 nationwide telephone survey of 3,500 employers were used as the basis for statistical models of voluntary and involuntary job separations and job promotions. Four major conclusions resulted from the modeling process developed. First, on-the-job training is negatively related to quits and employer-initiated separations and is positively related to promotions. Second, education does not seem to be related to employment separation but is positively related to promotion. Third, employment outcomes are more dependent on firm and job characteristics than on worker characteristics. Fourth, individual job search and employer recruitment and selection behavior directs "better" workers (more human capital) into good jobs. These four conclusions produce a heuristic model according to which (1) hiring processes (consisting of individual job search and employer recruitment and selection processes) result in a sorting of workers into jobs and firms and (2) the training policies and characteristics of those jobs and firms tend to determine the outcomes of the employment relationships that are formed. Overall, the study findings seem to highlight supply-side interventions. (MN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED297157

EDUCATION, TRAINING, AND EMPLOYMENT OUTCOMES: ANALYSIS OF A NATIONAL SURVEY OF EMPLOYERS

Final Technical Report

Kevin Hollenbeck

The National Center for Research in Vocational Education
The Ohio State University
1960 Kenny Road
Columbus, OH 43210-1090

November 1984

CE050674

BEST COPY AVAILABLE

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

FUNDING INFORMATION

Project Title:	Employer Survey Analysis
Grant Number:	NIE-G-83-0005, P-2
Project Number:	715904
Act under Which Funds Were Administered:	P.L. 96-88
Source of Contract:	National Institute of Education U.S. Department of Education Washington, D.C. 20202
Project Officer:	Ronald Bucknam
Contractor:	The National Center for Research in Vocational Education The Ohio State University Columbus, OH 43210
Executive Director:	Robert E. Taylor
Disclaimer:	This publication was prepared pursuant to a contract with the National Institute of Education, U.S. Department of Education. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their judgement in professional and technical matters. Points of view or opinions do not, therefore, necessarily represent official U.S. Department of Education position or policy.
Discrimination Prohibited:	Title VI of the Civil Rights Act of 1964 states: "No person in the United States shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance." Title IX of the Education Amendments of 1972 states: "No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance." Therefore, the Research Program on Employability, like every program or activity receiving financial assistance from the U.S. Department of Education, must be operated in compliance with these laws.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES. v

FOREWORD. vii

1. THE ROLE OF EDUCATION AND TRAINING IN THE ECONOMY 1

2. THE INFLUENCE OF EDUCATION AND TRAINING ON EMPLOYMENT SEPARATIONS . . 5

   2.1 Prior Research 5

   2.2 An Efficient Separations Modeling Framework. 12

   2.3 Separations as a Stochastic Process. 18

3. THE INFLUENCE OF EDUCATION AND TRAINING ON JOB PROMOTIONS 25

   3.1 Prior Research 25

   3.2 Theory and Empirical Estimates 25

4. CONCLUSIONS AND POLICY IMPLICATIONS 31

REFERENCES. 37

LIST OF TABLES

TABLE

1. Means and Standard Deviations of Variables Used in the Analyses of Separations from the Employer Survey. 14

2. Cross-sectional Models of the Determinants of Voluntary and Involuntary Separations 15

3. Estimates of Models of Voluntary and Involuntary Separations from a Time Independent, Continuous Time Stochastic Process Model. . . . 21

4. Determinants of Promotions Estimated by a Cross-sectional Logit Technique 27

5. Determinants of Promotions Estimated by RATE with Time Independence and with Time Dependence Assumptions 29

LIST OF FIGURES

FIGURE

4.1 The job outcome spectrum 31

4.2 Employment relationship with the job outcome spectrum. 32

4.3 Job search, employment, and job outcome spectrum 32

4.4 Job search, employment, and job outcome processes implied by the research. 35

FOREWORD

The overall purpose of the research program on employability development is to examine the processes involved in how youth get, keep, and succeed in jobs. Educational preparation and the provision of training on the job are important mediating factors in determining how youth get jobs and in determining the productivity of young workers in their jobs. Most prior research, however, has stopped at the point of considering the role of education and training on job search and productivity. The purpose of this study is to examine the influence of education and training on employment outcomes such as job separations or promotions. Without studying employment outcomes, our knowledge about the effects of education and training on workers is incomplete.

Through funding provided by the National Institute of Education, the National Center for Research in Vocational Education commissioned the Gallup Organization to conduct telephone interviews with a nationwide survey of over 3,500 employers. This report is one of a series of papers analyzing how employers select and train new workers and the outcomes of the employment relationships with young workers.

This research would not have been possible without the cooperation and assistance of those employers who so graciously responded to a telephone interview. We greatly appreciate the time and the insignts that these very busy men and women contributed to the study.

We wish to express our gratitude to the National Institute of Education for sponsorship of this study and to Ronald Bucknam, the project officer, for his guidance and support. We also wish to thank Mark Berger, Professor of Economics, University of Kentucky, and Paul Campbell, Senior Research Specialist, of the National Center for Research in Vocational Education for their insightful comments and critiques of this report.

Recognition is due Kevin Hollenbeck for directing the study; Stephen Mahle and Bruce Smith, Graduate Research Associates, for data processing and analysis; Judy Balogh for editorial assistance; and Cathy Jones for her expert typing and preparation of the report.

Robert E. Taylor
Executive Director
National Center for Research
in Vocational Education

1. THE ROLE OF EDUCATION AND TRAINING IN THE ECONOMY

This report is the third in a series of National Institute of Education-sponsored research reports concerning employers' perspectives on youthful workers based on data from a 1982 survey of over 3,500 employers. This data source, the Employer Survey, measured--

- the extent and nature of on the job training (OJT) provided by private employers to new employees,
- the benefits that employers receive from being able to hire already trained workers, and
- the recruitment strategies that firms employ to obtain the best possible workers.

The first study estimated the social payoff to vocational education and prior job experience. This payoff came in the form of reduced training costs and greater productivity (Bishop 1983). The second report presented an intensive study of hiring practices (Bishop 1984). The broad objective of this report is to examine the relationship of education and training to employment outcomes. To set the stage for this analysis, the roles of education and training in the economy will be discussed.

The role that education plays in the economy has been the subject of much debate. Fundamentally, the question may be posed as to what extent does education act as a catalyst in the productive process. On one hand, it has been suggested that education is nonproductive; rather, it acts as a signaling or credentialing device (see Arrow [1973] and Spence [1972, 1973]). The assumptions of this theory are that the labor force is heterogeneous in its productive capability, and the cost of acquiring education (or educational credentials) is inversely related to ability. Therefore, to get the most able workers, employers can offer wages high enough to cover the educational costs of the most capable workers but not high enough to provide a reasonable rate of return for less capable individuals. Human capital theory (see Becker [1975]), on the other hand, suggests that education is labor augmenting, that is, it increases the productivity of the individual. This theory suggests that education imparts knowledge or skills that cause workers to be more efficient in their jobs. Both of these theories predict that if two otherwise

identical individuals hold the same job at the same firm, the one with higher educational attainment will be more productive.

Yet a different theory (proposed by Thurow [1974]), suggests that productivity is tied up in the job and firm and is independent of the worker. In this theory, the queuing theory, an individual's education determines his or her position in the labor market queue. More education places one closer to the beginning of the queue, so the payoff to education comes from an increased likelihood of employment in "better" jobs. Indeed, Hollenbeck and Smith (1984) find that grades and certain courses of study such as cooperative education programs do improve the likelihood of employment, ceteris paribus.

However, Bishop (1983) presents evidence from the Employer Survey that certain educational experiences do affect productivity, at least in the early stages of a job. Specifically, by comparing two workers in the same job, the study found that relevant vocational education improved productivity ratings and decreased training time. Indeed it was found that relevant vocational education provided individuals a return in the form of higher wages and the employer a return in terms of reduced training costs and increased productivity that exceeded the higher wages.

On the job training (OJT) is obviously an important mediating influence between educational attainment and worker productivity. Research has shown, and common sense suggests, that training either on the current job or in prior jobs will significantly improve worker productivity. In fact, as just discussed, it has been shown that relevant work experience provides a payoff to employers. However, Bishop and Kang (1984) develop a theoretical model that implies that workers and firms underinvest in (general) training. There is a good deal of empirical evidence supporting this finding. Studies that have estimated the return to OJT find that rates of return are very high (Rosen 1982, Mincer 1974), which implies that market forces are somehow restricted so as to inflate artificially the rate of return. The restrictions are "externalities" generated by training, such as third party benefits that are not considered in the employer/worker training decision making. Other employers who hire workers away from their current employer will get benefits from general knowledge and skills received from on the job training. Furthermore, there are societal gains from trained workers as well. For example, trained

individuals have higher incomes and thus pay more in taxes. Also trained individuals are less likely to engage in criminal activities. None of these benefits affect the decision of how much training an employer should give a worker. That decision is based solely on the payoff to the worker and the firm.

Most prior research on the role of education and training in the economy ceases at the point of consideration of worker productivity. Education is directly related to productivity and earnings because of credentialing, augmented human capital, or job queuing. Training is directly related to productivity (and earnings), although externalities cause an underinvestment in it. To complete the argument, the role of education and training in determining employment outcomes must be considered. Job separations are costly and may offset any productivity gains from education and training if such human capital enhancement activities are directly correlated with separations. On the other hand, some employment relationships succeed to the point that a promotion occurs, that is a recontracting of labor services into a different job. Promotions are a "bonus" to the employer that may augment worker and employer payoffs to education and training. Without studying employment outcomes, our knowledge about the effects of education and training on workers is incomplete. Thus, the purpose of this report is to examine those outcomes.

In the next chapter of the report, the influence of education and training on employment separations is considered. Separations are characterized as being voluntary or involuntary in nature and are analyzed separately. Chapter 3 examines the determinants of promotions and the final chapter offers some conclusions and policy implications.

2. THE INFLUENCE OF EDUCATION AND TRAINING ON EMPLOYMENT SEPARATIONS

2.1 Prior Research

Given the wide variety of employment arrangements that do or potentially could exist in the economy, it is not surprising that a number of alternative theoretical frameworks have been offered by economists in the recent literature. Of course, the basis of the labor market exchange is rather straightforward and completely general. The owners of labor services (workers) sell those services to economic agents interested in combining such labor resources with other factors of production in order to create goods or services that have exchange value in and of themselves. But the terms of the sale of labor services may involve piece rates, nonpecuniary benefits, deferred compensation, temporary employment, explicit contracts, collectively bargained contracts, and any of a myriad of other features that may or may not resemble characteristics of "typical" market exchanges.

Economists have been prolific in their recent attempts to explain the existence of and rationale for various features of the labor market. Thus it is beyond the scope of this paper to review all of the recent work related to the nature of employment relationships. (Parsons [1984] does a credible job in organizing and reviewing a wide body of work dealing with the nature of employment in the context of contracts.) Instead this section will highlight work germane to the question of why some employment spells result in separations. (Separations here mean severed employment ties that were unexpected at the time of hiring, or more generally, were not anticipated by both parties to the labor market exchange.) Studies are classified by whether their approaches emphasize search theory, specific human capital, job matching, or institutional factors. Finally, recent empirical studies are reviewed.

Search Theory

The primary emphasis of search theoretic models is to explain the duration of unemployment spells. In the search theory paradigm, individuals (employed

or unemployed) choose jobs among alternative firms by trading off search costs for future financial and nonpecuniary returns (generally proxied by wage offers). Parsons (1977) lists the five key elements of the job search environment:

- The distribution of wage offers
- The costs of search
- Explicit or implicit job duration
- The searcher's state of knowledge
- The contracting terms

Parsons (1977) and Lippman and McCall (1976a; 1976b) review extensively search models that vary in their handling of the five elements listed here.

A problem with search theory models, for our purposes, is that they can only be applied to quits. (Burdett and Mortensen [1980] do extend the theory of job search to include the case in which job prospects are characterized by layoff risk as well as the wage.) Quits occur when employed job seekers engage in job search and find alternatives in which future wage opportunities exceed those in their current jobs. Parsons (1973) uses such a model along with an explicit job search cost function to generate the hypotheses that the likelihood of a quit increases with the dispersion of the wage offer distribution and with the vacancy rate and decreases with relative wages and search costs. Burdett (1978) develops an equilibrium search model where quits are part of an optimal search theory. Furthermore, the theory implies that the probability of quitting decreases with age (and thus tenure, through its correlation with age).

The type of quits in the Parsons and Burdett models is somewhat limited. Lippman and McCall (1981) and Jovanovic (1979) liken such quits to those that would occur only if a job was a search good, using Nelson's (1970) terminology. (A search good is one in which all qualities of the good are known prior to purchase.) Lippman and McCall (1981) examine the possibility that a job may be an experience good, in which certain aspects of the job become known only by "experiencing" the job. If the belated information is distasteful, then the worker may choose to quit. A strain of development of

search models in which experience quits occur may be entitled systematic search models. In these models, the searcher has some knowledge about the distribution of wage offers. Salop (1973) assumes that the searcher knows where a firm lies in the wage distribution but doesn't know whether or not there is a vacancy. Weitzman (1979) examines the case where the searcher has formed priors on the wage offer distribution and McCall and McCall (1981) extend the systematic search model to account for belated information.

The McCall and McCall (1981) multiarmed bandit framework draws attention to a particular weak point of search models, namely the passiveness of the purchasers of the labor services. In a sophisticated fashion, the McCall analysis has let to an optimal strategy of systematic search, testing of jobs, and quitting as if employers were inanimate slot machines and employment relationships were games of chance. In the real world, not only are searchers attempting to decide what slots to play and for how long, but also the slot machines (i.e., employers) are searching for gamblers whom they will allow to play. Principal-agent contracting frameworks in which either party can terminate the contract seem more realistic in this regard.

Specific Human Capital

The basis tenents of the specific human capital model are well known. Labor is a "quasi-fixed" factor (Oi 1962) for which employers may make substantial investments. These investments typically take the form of specific human capital. It is intuitively clear that the larger the investment, the less likely there will be a separation. However, separation will occur when uncertainty (at the time of the investment) is modeled into the employment relationship.

In a fixed wage contract with no separation damages (see Becker [1975] and Oi [1962]), employers will initiate a termination if demand shocks cause the value of the marginal product of the worker to decline below the wage. Employees will quit if there is an exogenous random shock to their value of marginal product at the next best alternative, causing it to be greater than their current (fixed) wage. However, Parsons (1984) demonstrates that separations that occur in a fixed wage contract may not be efficient. Intuitively, this is because at the same time that the worker's value marginal product (VMP) at the next best alternative randomly increases above the wage, the firm's product demand random shock may cause the VMP at the firm to increase

as well, and a recontracting at a higher wage would be more efficient than separation (and vice versa for declines). Becker (1975) suggests that there is a optimal investment sharing that will minimize the separation inefficiency. Hashimoto (1981) formalizes the argument. If there is more uncertainty in the product market than in the worker's alternative value of marginal product, then the firm should bear a larger share of the investment and vice versa, if the uncertainty in the worker's productivity is greater. Obviously such an agreement would require knowledge about the uncertainty, an informational requirement that may not be realistic. Hashimoto and Yu (1980) argue that, even though it may not be possible to observe the uncertainty affecting a worker's VMP at his own firm or the uncertainty affecting his wage prospects at other firms, there may be observable proxies that can be used in a flexible wage contract. Hashimoto and Yu use the example of number and quality of publications being used to determine faculty salaries (p. 543).

The specific human capital models provide hypotheses about variables likely to affect separations. First of all, specific training and recruitment costs should reduce both employer- and employee-initiated separations. Positive indicators of product demand such as firm growth should be negatively related to layoffs. Indicators of alternative wage prospects such as the tightness of the labor market should influence quits.

Job Matching

Yet a different framework for explaining separations may be referred to as job matching theory. In the job-shopping framework of Johnson (1978), returns to employment have two types of uncertainty: a return to general ability and a return to worker/job specificity. This theory leads to risk neutral workers trying out the riskiest jobs (most earnings dispersion) first in order to learn about the returns they can expect from their own general ability. With that information, each worker will select another job with less earnings uncertainty unless the return to the worker/job specificity in the first job is high. Two implications of this theory are (1) earnings dispersion should decline with age across identical workers and (2) education should reduce job mobility by providing the worker with a priori information on his expected returns to general ability.

Jovanovic (1979, 1984) has developed a job matching model in which turnover is the optimal reassignment of workers to jobs caused by the accumulation of better information with time. "The model predicts that workers remain on jobs in which their productivity is revealed to be relatively high and that they select themselves out of jobs in which their productivity is revealed to be low" (1979, p. 974). Because mismatches are likely to be found earlier rather than later, the job matching framework predicts a strong inverse relationship between job tenure and separation. Similarly, the average productivity of the work force in a firm should rise with tenure.

The assumptions underlying the Jovanovic job matching model are rather strong--individualized contracts and infinite lifetimes--but an interesting theoretical result is that the tenure-separation relationship is direct at first and eventually switches signs. Flinn and Heckman (1983) find that controlling for unobserved heterogeneity, the job-to-unemployment hazard shows an initial increase and then declines.

Institutional Factors

Freeman (1980) has proposed that unions reduce quits by giving employees a greater opportunity to vent their dissatisfaction. Using Freeman's terminology, allowing employees to have a greater "voice" reduces their propensity to "exit." The implication is that since the employer can have an impact on the amount of quits, he or she may be willing to give employees a voice through their unions even if it adds to firm costs. This theory suggests that turnover should be lower in unionized firms.

The internal labor market literature based on the original work of Doeringer and Piore (1971) offers yet another reason why firm characteristics should influence turnover. In the primary market, firms create internal career paths in order to facilitate the transmission of knowledge and to reduce turnover. This is done to protect their investment in the worker's human capital. Although wages might be lower if external labor markets were used, the resulting dissatisfaction and quits would add more to costs than they would save in wages. The implication of the internal labor market literature is that turnover analysis should examine the type of organization of the firm in addition to other firm characteristics.

Empirical Studies of Turnover

Using firm-level data, Stoikov and Raimon (1968) found the following five results:

- An inverse relationship between annual earnings (adjusted for the quality of the workplace) and the quit rate
- An inverse relationship between the percentage increase in earnings and the quit rate
- The better the union grievance procedure, the lower the quit rate
- The higher the layoff rate in an industry relative to other industries, the higher the propensity to quit
- The higher the skill level, the lower the quit rates

Parsons (1973) examined data over the period 1959-68 for 27 manufacturing industries. He reports that although relative wages appear to be somewhat important in adversely affecting an industry's quit rate (9 of 27 industries show a significant negative relationship), changes in workers' wages do not affect significantly the level of quits. Other findings were that vacancies are a significant factor in positively affecting the quit rate (a modal elasticity in the range of one) and seasonal influences (school, Christmas holidays) are also significant factors that need to be controlled. In an earlier study based on 1959 and 1963 data, Parsons (1972) found that wage income was inversely related to the quit rate but positively associated with the layoff rate. He also reports that both the quit and layoff rates are lower when training is more specific and when there is lower concentration in the industry.

Burton and Parker (1969) also examined the influence of concentration on industrial quit rates. Contrary to Parsons, they report that concentration is inversely related to the quit rate. They further found that wage changes are significant in reducing quit rates, unionization decreases quit rates, skill levels do not seem to influence quit rates, and males, whites, and workers in the South have lower quit rates.

More recent studies have examined individual microdata to analyze the determinants of turnover. Mincer and Jovanovic (1981) examined data from the young and the mature male cohorts of the National Longitudinal Survey (NLS).

Their findings included a significant negative tenure-separation relationship. The emphasis of their analysis was really on life-cycle effects, and they find the following:

- One-fourth of wage growth over the life-cycle is explained by specific capital investment
- For young men, there is no relationship between prior job turnover and current wage or tenure
- For mature men, a high turnover rate results in firms offering little specific training and is associated with a lower wage

Meitzen (1982) analyzed quits and discharges of recently hired workers from the first wave of the Employer Survey. The study found that the probability of a worker quit is inversely related to the size of the establishment, the extent of firm unionization, the amount of prehire screening done by the firm, wages, and the worker's age. Other notable results from the quit equation include the negative effects on the probability of quitting of (1) the amount of prehire screening done by the firm, (2) the top wage of the job slot in which the worker was hired, and (3) the age of the worker at the time of hire. The results of the discharge equation were rather poor, as only a few of the coefficients were statistically significant.

Bishop (1982) also analyzed turnover from the first wave of the Employer Survey. Separate probit models were estimated predicting voluntary and involuntary turnover. It was found that the determinants of voluntary turnover were very different from the determinants of involuntary turnover. Being female and having more years of schooling increased the likelihood of quitting but decreased the likelihood of separating involuntarily. Higher relative wages in craft occupations were associated with significantly lower quit rates but slightly higher rates of involuntary separation. Unionized firms had considerably lower quit and dismissal rates but considerably higher layoff rates. Eighteen of the 23 coefficients estimated had opposite signs in the 2 equations.

For purposes of this report, two theoretical frameworks were specified for both employment separations and promotions. They are referred to as an efficient separations framework and a continuous time stochastic process model.

2.2 An Efficient Separations Modeling Framework

Let $p_{ij}(u,t,X_u)$ represent the probability that an individual characterized by a vector of personal and employment relationship attributes X_u will move from employment state i at time u to employment state j at time t($u \leq t$). In general, there are K employment states, but in this and its ensuing section, assume K=2 (employment and voluntary separation or employment and involuntary separation). The unconditional probability of being in a particular employment state at time t given X may be denoted $p_i(t,X)$, $i = 0,1$.

Following Parsons (1984), "assume a simple model in which a worker's productivity in the firm and productivity in the next best alternative are subject to random shocks but a capital investment (OJT) must be undertaken prior to the discovery of these random effects." (p. 24) In particular, assume that in the postinvestment period

(1) $V_i = Z_i + e_i \qquad (i=0,1)$

where V_i = productivity of typical worker in job i, (0 corresponds to own firm, 1 corresponds to next best alternative),

Z_i = permanent component of productivity, and

e_i = random productivity element.

In general, Z_0 is positively related to the capital investment.

Assume that $E(e_i) = 0$ and that $Z_0 > Z_1$ by an amount sufficient to make the capital investment profitable on average.

Efficient separation will occur when

(2) $V_0 \leq V_1$ or $Z_0 + e_0 \leq Z_1 + e_1$.

In other words, a random drawing occurs at the end of the investment period. We interpret e_0 as if it is revealed to employers--outlying positive e_0's cause promotions to be initiated, outlying negative e_0's cause discharges or layoffs. On the other hand, e_1 is revealed to the worker and a large e_1 will cause the worker to quit.

Assuming that the workers in the firm are heterogeneous and that the heterogeneity of the jth worker can be captured by the linear form $Z_{ij} = X_{ij}B_i$, and the e_{ij} are independently and identically distributed across workers, (2) can be rewritten as separation occuring when

(3) $\quad X_{0j}B_0 + e_{0j} \leq X_{1j}B_1 + e_{1j}.$

If we assume that the e_{ij} are distributed from a Weibull density function, and thus their differences are distributed with a logistic distribution, then the probability of separation of the jth worker can be written as

(4) $\quad p_1(X_j) = \text{prob}\,(e_{0j}-e_{1j} \leq X_{1j}B_1-X_{0j}B_0) = 1/\left(1 + e^{X_{0j}B_0 - X_{1j}B_1}\right).$

The log-odds ratio of the choice of nonemployment to employment is then just a binary logit specification.

$$(5)\quad \ln\left(\frac{p_1(X_j)}{p_0(X_j)}\right) = \ln\left(\frac{p_{11}(X_j)}{1-p_1(X_j)}\right) = \ln\left(\frac{1}{e^{X_{0j}B_0-X_{1j}B_1}}\right)$$

$$= B_1X_{1j} - B_0X_{0j}$$

$$= B_1X_{1j} \text{ (assuming normalization of } B_0 \rightarrow 0)$$

The empirical work in this and the next section is based on the Employer Survey. Table 1 provides means and standard deviations for the relevant variables from that survey.

Table 2 presents logit estimates of voluntary and involuntary separations. The first thing to note about the model estimates is that consistent with most of the theoretical literature, market conditions affect both voluntary and involuntary separations. When the labor market is tight, workers have numerous alternatives and are therefore more likely to leave their jobs. But also, when the market is tight, the quality of applicants and new hires decreases resulting in higher rates of involuntary separations as well. The market variable used in the regressions reported in table 2 is a dummy variable indicating that employers find it difficult "to find unskilled labor at reasonable

TABLE 1

MEANS AND STANDARD DEVIATIONS OF VARIABLES USED IN THE ANALYSES OF SEPARATIONS FROM THE EMPLOYER SURVEY

Variable	Mean	Std. Dev.
Separations	.287	.453
Age at hire	27.389	9.621
Male	.550	.498
Prior relevant experience (months)	29.801	55.969
Years of educ.	12.486	1.687
Years of vocational educ.	.706	1.252
Referral by friend, relative, or other employer	.378	.485
Subsidy (1 = yes; 2 = no)	1.957	.204
Ln hours spent on hiring typical worker	1.619	1.372
Current wage	$5.962	3.203
Typical 2-year wage	$5.995	2.819
Ln hours spent training typical worker	2.016	1.425
Training is general	.730	.444
Ln machine cost	1.722	1.676
Paperwork req'd to fire (1 = lots)	.336	.472
Probationary period (1 = yes)	.726	.448
Length probationary period (weeks)	6.943	8.366
Clerical occupation	.233	.423
Job has no promotion opportunity	.074	.262
Ln establishment size	2.864	1.579
Percentage union	9.659	26.779
Percentage workers under 25	28.665	25.805
Construction industry	.069	.253
Difficult to find workers	.169	.375
Temporary worker	.146	.353

TABLE 2

CROSS-SECTIONAL MODELS OF THE DETERMINANTS OF VOLUNTARY AND INVOLUNTARY SEPARATIONS

Variables	Voluntary Separations		Involuntary Separations	
Worker characteristics				
Age at hire	-.019***	(6.71)	.005	(.41)
Male	-.032	(.06)	.340**	(4.39)
Prior relevant experience	-.001	(.86)	-.002	(1.40)
Years of education	-.009	(.06)	-.007	(.03)
Years of vocational educ.	-.022	(.23)	-.034	(.40)
Characteristics of worker/ employer search				
Referred by friend, relative, or other employer	-.351***	(9.00)	-.344***	(6.04)
Subsidy received	.264	(.95)	-.331	(1.44)
Log hours spent on hiring	.026	(.31)	.029	(.30)
Characteristics of job				
Wage	-.121***	(16.52)	.005	(.04)
Log training time	-.108***	(6.25)	-.077*	(2.76)
Training is general	.059	(.24)	.101	(.45)
Log machine cost	-.015	(.16)	-.008***	(6.04)
Paperwork req'd to fire	.103	(.60)	.452***	(8.96)
Probationary period dummy	.401***	(7.28)	.097	(.30)
Clerical	-.332***	(5.11)	-.044	(.03)
No promotion opportunity	-.277	(1.64)	-.277	(1.64)
Characteristics of firm				
Log establishment size	-.182***	(15.98)	-.231***	(19.11)
Percentage union	-.002	(.53)	.004*	(2.78)
Percentage under 25	-.002	(.84)	-.004	(2.41)
Construction	.552**	(5.79)	.943***	(19.25)
Market characteristics				
Difficult to find	.452***	(10.72)	.313*	(3.60)
Tenure allowed to shift	X		X	
-2 log likelihood	2224.63		1699.14	
Proportion separated	.183		.128	
Sample size	2500		2341	

Note: Chi-square statistics are in parentheses.

*p ≤ .10

**p ≤ .05

***p ≤ .01

wages," the coefficients for this variable are positive and statistically significant. Bishop (1982) and Meitzen (1982) found positive but not statistically significant effects of market conditions on voluntary quits, whereas Parsons (1972) found a strong positive relationship between vacancies and quit rates.

There are numerous reasons to hypothesize a negative relationship between firm size and voluntary or involuntary separations. First of all, firm size may be an indicator of the strength of internal job ladders and promotion opportunities. Larger firms are more likely to offer training and advancement opportunities than smaller firms and this should reduce voluntary separations. Second, larger firms may offer higher levels of nonwage compensation (fringe benefits) or nonpecuniary benefits so that part of the firm size effect is really a compensation effect, for which an inverse relationship with quits is hypothesized. Third, larger firms are more likely to have formal personnel offices and more extensive screening mechanisms in place. This would decrease the number of involuntary separations and may decrease voluntary separations for two reasons: formal personnel mechanisms may give workers a "voice" as in Freeman's (1980) exit-voice argument, thus reducing quits; the screening mechanism in the hiring function are able to perceive and minimize workers' propensities to quit. Finally, smaller firms are likely to be operating on the margin and are subject to adverse product demand shocks. The results in the tables confirm these hypotheses. In prior studies also, firm size was generally a negative correlate with quit rates (see Meitzen [1982], Stoikov and Raimon [1968], and Burton and Parker [1969]).

Other firm characteristics entered into the model were a dummy variable for the construction industry, the percentage of the nonmanagerial work force covered by collective bargaining, and the percentage of workers under age 25. The percentage unionization coefficient had the expected negative sign in the voluntary separation equation, but the coefficient was not statistically significant. The positive sign on the percentage unionized variable in the involuntary equation stems from layoffs. A large number of layoffs were reported in the data (the data collection period coincided with a broad recession in the economy), and unionized firms have a much higher likelihood of having established layoff mechanisms. The percentage of workers under age 25 had an

inverse (but not statistically significant) relationship with voluntary and involuntary separations. This variable may serve as a proxy for the rate of growth of the firm since if layoffs were occurring, then the percentage of workers under 25 would likely be decreasing; furthermore, if hiring were taking place, that percentage would probably be increasing. If the firm is growing, theory would predict an inverse relationship with quits, which is observed. Workers in the construction industry are much more likely to experience an involuntary or voluntary separation than workers in other industries.

Interestingly, only two of the worker characteristics variables had statistical significance in either the voluntary or involuntary separation equations over the full sample. The age at hire is inversely related to quits and males have a higher likelihood of an involuntary separation. The negative age-voluntary separation relationship is one of the most pervasive empirical results in the turnover literature. As discussed above, some of the relationship is spurious due to workers with low productivity in the job sorting themselves out, but still there is structural dependence due to less mobility on the part of older workers, higher values of specific investment in the worker, and so forth.

Males have a much higher probability of an involuntary separation than females, but there is no gender difference in the voluntary separations equation. Having prior relevant work experience reduces the likelihood of either a voluntary or involuntary separation, but the effect on is not statistically significant.

The a priori hypotheses about the influence of variables that might be characterized as describing the worker or employer search and recruitment on turnover are that informal referral sources will decrease both voluntary and involuntary separations since such referrals improve the amount of and validity of information obtained by the employer at the time of hire, and, likewise, the search investment cost should decrease separations. The direction of effect for whether a worker is subsidized or not is ambiguous. To the extent that such workers are stigmatized as having low productivity and low employability, turnover may be increased. However, because wages are subsidized and subsidy program rules provide employers with an incentive to keep

the workers for a substantial period of time, turnover may be diminished. As seen in table 2, the negative influence of referrals by friends, relatives, or other employers upon turnover is a strong one for all workers. Obviously, such referrals result in less voluntary turnover (the employee will know more about the firm prior to taking a job, decreasing the likelihood of an experience quit) and less involuntary turnover (more productive workers are hired). Surprisingly, the (log of) person-hours spent on the hire did not reduce either quits or involuntary separations. This contrasts with Meitzen (1982) who found a significant negative effect on the hours spent recruiting. If the hiree was subsidized (e.g., with a TJTC), there is an increased probability of a voluntary separation and a decreased probability of an involuntary separation (although neither effect was statistically significant).

The last set of variables presented in table 2 are characteristics of the job. The current or most recent wage has a negative sign in the voluntary quit model, which is consistent with the search models of turnover. A higher wage is more likely to better the next best alternative. The amount of time needed for a worker to become trained fully is also negatively associated with quits (both voluntary and involuntary, although the former is only statistically significant at the 10 percent level). This result is consistent with the prediction that the more training, the less likely a separation will occur. In this sample, clerical workers were far less likely to quit than other occupations.

Two variables that were intended to measure the effect of job security on turnover were whether or not there was a formal probationary period and whether or not a great deal of paperwork is required to discharge a worker after a formal probationary period. A priori expectations were that both variables would be negatively associated with turnover, since firms would be more careful in their hiring standards to avoid the costs of discharging workers. However, table 2 indicates just the opposite. The variable indicating that a lot of paperwork is required to discharge a worker is <u>positively</u> associated with involuntary separations, and the dummy variable indicating a formal probationary period for workers is <u>positively</u> associated with voluntary quits. The unexpected positive association between the paperwork required to discharge an individual variable and the probability of an employer-initiated discharge may

result from the fact that only employers who actually do terminate employees have to complete the paperwork or may consider the paperwork to be a burden. In other words, the causality may be reverse--a lot of discharges causes the respondent to report that a lot of paperwork is required to terminate an employee, so the variable does not in fact measure a per discharge cost to the employer.

2.3 Separations as a Stochastic Process

The model in the preceding section lacks some generality because time is not explicitly modeled. In fact, in that model, there is an investment period, a random drawing, and a second period in which workers separate or stay at their job. But in general, separations can and do occur at almost any time during the course of the employment relationship. The duration of the completed spell of employment is observed in the Employer Survey for workers who had separated by the survey date and the incomplete spell length is observed for workers still in their jobs. A different type of analysis can be undertaken by assuming that the employment relationship is a continuous time Markov process.*

First of all, assume a homogeneous population so that

(1) $p_{ij}(u,t,X_u) = p_{ij}(u,t)$, where $p_{ij}(u,t,X_u)$ as defined above.

Let P(u,t) denote the matrix of $p_{ij}(u,t)$, that as stated above will be 2 x 2. Note that the rows of P sum to unity for all u,t.

Define $r_{ij}(t)$, the instantaneous rate of transition from state i to state j at time t, as the following:

(2) $$r_{ij}(t) = \lim_{\Delta t \to 0} \frac{p_{ij}(t,t+\Delta t)}{\Delta t}, \quad i \neq j$$

*At the outset, it is admitted that the assumptions of a Markov process, such as the probability of leaving a state are not dependent on the length of time in the state, are inconsistent with theoretical sorting models like Jovanovic's (1979), and the empirical results like, "The strongest and most consistent finding of all these studies is a negative relationship between quits and layoffs on the one hand, and job tenure on the other" (p. 972). For our purposes then assume that the period of observation in the Employer Survey is short-run enough that sorting mechanisms do not yet hold and a continuous time Markov process is realistic.

The rate of leaving state i at time t, $r_i(t)$, is equal to the sum of $r_{ij}(t)$ over $j \neq i$. That is,

$$(3) \quad r_i(t) = \sum_{i \neq j} r_{ij}(t).$$

Call R(t), defined as the matrix with ij-th element equal to $r_{ij}(t)$ and ith diagonal equal to $-r_i(t)$, the instantaneous rate (or hazard rate) matrix. Note that rows of R(t) sum to 0 for all t. The question may be asked how R(t) relates to P(u,t). Under (weak) continuity and regularity assumptions, it can be shown (see Feller [1968, chapter XVII]), that

$$(4) \quad \frac{dP(u,t)}{dt} = P(u,t)R(t).$$

Another result of the Markov process assumption is that the length of time between transitions has an exponential distribution whose parameter depends on the transition rates. Let $F_i(t|u)$ be the probability of a transition from state i (to any different state) before time t, given that state i is occupied at time u. The survivor function, $G_i(t|u)$, will be defined as $1 - F_i(t|u)$.

For the special assumption that $r_{ij}(t) = r_i$, that is, no time dependence, then (4) solves to

$$(5) \quad P(u,t) = e^{(t-u)R},$$

and the survivor function becomes

$$(6) \quad G_i(t|u) = e^{-(t-u)r_i}.$$

Finally, if we drop the assumption of population homogeneity and replace it with the following assumption about sample heterogeneity,

$$(7) \quad r_{ij}(t,X) = e^{\theta_i X},$$

we can estimate the parameters θ_i with maximum likelihood using the survivor function (6).

Table 3 provides such maximum likelihood estimates (from Tuma's [1980] RATE package) for voluntary and involuntary separations. The results reported in table 3 are very similar to those given in the previous table. Variables that are negatively associated with voluntary separations are the age at hire; referred by a friend, relative, or other employer; current (or most recent) wage; log of the time required to be trained fully in the job;

job; clerical occupation dummy variable; and log of the establishment size. Variables that are positively associated with quits are a probationary period dummy variable, a construction industry dummy variable, and the variable indicating tightness of the local labor market.

For involuntary separations, the following relationships hold in the full sample:

Variables positively related to involuntary separations	Variables negatively related to involuntary separations
• Males	• Referrals by friends, relatives, other employers
• Lots of paperwork required to discharge	• Log training time
• Construction industry	• Log establishment size
• Tight labor market	

The similarity of the maximum likelihood estimates to the cross-sectional logit estimates is not unexpected as can be analytically shown. For the time independent model, equation (5) can be solved in the two-state case for $p_{12}(u,t)$, that is the unconditional probability of making a transition from employment to nonemployment. In fact,*

$$(8) \quad p_{12}(u,t) = \frac{r_{12}}{r_{12} + r_{21}} \left[1-e^{-(r_{12} + r_{21})(t-u)}\right],$$

for $t>>u$, (8) becomes

---

*This is derived as follows:

Let $\tilde{R} = (t-u)R$. Let λ_1, λ_2 be eigenvalues of $\tilde{R}$.

$P = P(u,t) = e^{\tilde{R}} = M \Lambda M^{-1}$, where

M is matrix whose columns are eigenvectors of $\tilde{R}$, and

Λ is diagonal matrix where i-th diagonal is $\exp(\lambda_i)$. (Noble 1969)

Let $M = \begin{pmatrix} \alpha_1 & \alpha_2 \\ 1 & 1 \end{pmatrix}$, that is, a particular normalization of the eigenvectors of $\tilde{R}$.

$$\text{then } P_{12} = \frac{-\alpha_1\alpha_2}{\alpha_1 - \alpha_2} \exp(\lambda_1(t-u)) + \frac{\alpha_1\alpha_2}{\alpha_1 - \alpha_2} \exp(\lambda_2(t-u)),$$

$$\text{but } \lambda_1 = 0,\ \lambda_2 = -(r_{12}+r_{21}),\ \alpha_1 = 1, \text{ and } \alpha_2 = \frac{-r_{12}}{r_1 - (r_{12}+r_{21})} = \frac{-r_{12}}{r_{21}},$$

$$\text{then } p_{12} = \frac{r_{12}}{r_{12} + r_{21}} \left[1-e^{-(r_{12} + r_{21})(t-u)}\right].$$

TABLE 3

ESTIMATES OF MODELS OF VOLUNTARY AND INVOLUNTARY SEPARATIONS FROM A TIME INDEPENDENT, CONTINUOUS TIME STOCHASTIC PROCESS MODEL

Variables	Voluntary Separations		Involuntary Separations	
Worker characteristics				
Age at hire	-.014***	(2.15)	.008	(1.12)
Male	-.001	(.00)	.034***	(2.17)
Prior relevant experience	-.000	(.28)	.001	(.75)
Years of education	.017	(.53)	.020	(.53)
Years of vocational educ.	-.019	(.45)	-.035	(.70)
Characteristics of worker/ employer search				
Referred by friend, relative, or other employer	-.335***	(3.12)	-.359***	(2.70)
Subsidy received	.184	(.75)	-.308	(1.21)
Log hours spent on hiring	.028	(.69)	.020	(.41)
Characteristics of job				
Wage	-.157***	(5.20)	-.018	(.80)
Log training time	-.111***	(2.83)	-.088**	(2.01)
Training is general	.048	(.44)	.140	(.98)
Log machine cost	.021	(.63)	.001	(.27)
Paperwork req'd to fire	.063	(.52)	.405***	(2.82)
Probationary period dummy	.330***	(2.44)	.115	(.72)
Clerical	-.323***	(2.37)	-.004	(.00)
No promotion opportunity	-.279	(1.37)	-.130	(.53)
Characteristics of firm				
Log establishment size	-.087***	(2.18)	-.119***	(2.45)
Percentage union	-.001	(.62)	.003	(1.20)
Percentage under 25	.000	(.00)	-.001	(.39)
Construction	.474***	(2.29)	.899***	(4.77)
Market characteristics				
Difficult to find	.356***	(3.60)	.393***	(2.60)

Note: t-statistics are in parentheses.
*p ≤ .10
**p ≤ .05
***p ≤ .01

$$(9)\quad P_{12} = \frac{r_{12}}{r_{12} + r_{21}}$$

and the log-odds ratio can be written as (10).

$$(10)\quad \ln\left(\frac{p_{12}}{1-p_{12}}\right) = \ln\left(\frac{r_{12}}{r_{21}}\right) = \ln r_{12} - \ln r_{21}.$$

From (7) then, we have that the log-odds ratio is linear in X with coefficients equal to $\theta_1-\theta_2$. Call this difference α.

$$(11)\quad \ln\left(\frac{p_{12}}{1-p_{12}}\right) = (\theta_1-\theta_2)X = \alpha X.$$

The θ_1 were estimated and reported in table 2, whereas the α were estimated and reported in table 3. The importance of equation (11) is to show that statistically insignificant α coefficients may stem from approximately equal θ_1, θ_2 coefficients. Furthermore, a comparison of the θ_1 and α coefficients allows inferences about θ_2 coefficients (see Hollenbeck and Mahle [1984, p. 105]).

A more general assumption about the population heterogeneity of equation (7) was tested. In this case, it was assumed that the instantaneous transition rates were time dependent. In particular, the following assumption was made:

$$(12)\quad r_{ij}(t,X) = e^{\theta_i X} e^{\alpha t}.$$

The coefficient estimates from this model were quite similar to those reported in table 3. The time-dependence coefficient α was not statistically significant in either equation (although significance was much higher for quits than involuntary separations). It had a positive sign for voluntary separations and a negative sign for involuntary separations, implying that the instantaneous rates of transition as well as the transition probabilities for quits rose during the period of observation, whereas those of layoffs went down. Simply put, involuntary discharges tended to happen early in the employment relationships, whereas quits were relatively later.

It should be reemphasized that the time dependent model is still a Markovian specification, so that it is not consistent with state dependence,

that is, tenure or duration dependence. It is simply the case that the Markovian transition probabilities change with time. A second note concerning the time dependence model in (12) is that there may be an identification problem in which observed time dependence cannot be identified from a mispecification error in the population heterogeneity equation (7). Meitzen (1982) illustrates and discusses the problem by assuming that the X vector in (7) is missing an important unobserved variable like "propensity to quit" and corrects for this missing attribute with a multiplicative error term.

In the next chapter, similar models to the ones discussed here were estimated for promotions.

3. THE INFLUENCE OF EDUCATION AND TRAINING ON JOB PROMOTIONS

3.1 Prior Research

Little prior research has focused on the determinants of promotions. Wise (1975) analyzed data on promotions within a large corporation and concluded that important direct causal variables include college selectivity, college GPA, rank in graduate school, and leadership ability. Promotion likelihood was inversely related to desire for job security. Socioeconomic background did not influence promotion in this data set after controlling for college attributes.

Cho (1982) examined the influences of promotion likelihood on turnover propensity from both an ex ante (perceived likelihood of receiving a promotion) and ex post (actually did or did not receive promotion) perspective. As part of his empirical work, he estimated a model of the determinants of promotion (using PROBIT) and found the following siginificant covariates (p. 63):

Positive:	Negative:
• Training	• Tenure in job
• Prior promotions	• Skill level
	• Unionization
	• Job is repetitious
	• Male

3.2 Theory and Empirical Estimates

From the prior discussion, several hypotheses about the influence of worker/firm/job characteristics on the likelihood of promotion are suggested from the (scant) literature cited here. They are as follows:

- Age at hire. Likely to be negative. Older workers have fewer job alternatives; age may be correlated with tenure in job which has negative effect.
- Sex. Cho empirically found a negative effect for males.
- Education. Wise found a strong positive effect.
- Informal referrals. Should be positive since better matches result.

- Hours spent on hiring. Should be positive since it is indicative of the firm's effort to find a good match. The hiring investment should provide an incentive to recontract.

- Training. Should be positive as it improves the worker's productivity on his or her current job. The training investment is an incentive for the firm to recontract.

- Probationary period and Job has no promotion opportunity. These variables are essentially controls which should have positive and negative signs, respectively.

- Establishment size. Should be positive because of use of internal labor markets and since, on average, better applicants are attracted to larger firms.

- Unionization. Should be negative as found in Cho (1982).

- Labor market tightness. Should be positive since alternatives are likely to be attractive and firms must compete.

The respondents to the Employer Survey were asked if workers had "received a promotion, or an upgrading of (his/her) job responsibilities since being hired." As with voluntary and involuntary separations, the worker/firm choice of promotion or nonpromotion was modeled and estimated with a cross-sectional logit technique and under the assumption that receiving a promotion is a continuous time Markov process (using RATE).

Table 4 provides the cross-sectional logit estimates of the promotion model. With only a few exceptions, the estimates confirm the hypotheses set out above. Among worker characteristics, education has a positive relationship with the probability of a promotion. Age, on the other hand, has a negative relationship. Interestingly, the vocationally related human capital variables (months of prior relevant work experience and years of vocational education) are negatively related to promotion likelihood, although neither is statistically significant. Also not statistically significant but positive as hypothesized, is the influence of informal referrals on the probability of promotion. The firm's investment in hiring as represented by the (logarithm of) hours spent on hiring is positively related to promotion probability as well and is statistically significant. The (logarithm of) training time variable exhibits the same result, that is, a positive relationship as hypothesized.

TABLE 4

DETERMINANTS OF PROMOTIONS ESTIMATED
BY A CROSS-SECTIONAL LOGIT TECHNIQUE

Variables	Estimate	
Worker characteristics		
Age at hire	-.012***	(4.22)
Male	.053	(.27)
Prior relevant experience	-.001	(1.42)
Years of educ.	.063***	(5.75)
Years of vocational educ.	-.002	(.00)
Characteristics of worker/ employer search		
Referred by friend, relative, or other employer	.097	(1.19)
Subsidy received	-.176	(.79)
Log hours spent on hiring	.105***	(9.17)
Characteristics of job		
Wage	.019	(1.39)
Log training time	.118***	(13.75)
Training is general	-.119	(1.59)
Log machine cost	.016	(.34)
Paperwork req'd to fire	-.083	(.68)
Probationary period dummy	.499***	(18.56)
Clerical	.405***	(13.26)
No promotion opportunity	-.900***	(20.73)
Characteristics of firm		
Log establishment size	-.080***	(5.83)
Percentage union	-.004**	(3.88)
Percentage under 25	.007***	(16.74)
Construction	-.359**	(3.81)
Market characteristics		
Difficult to find	.030	(.07)
Tenure allowed to shift	X	
-2 log likelihood	3401.77	
Proportion promoted	.353	

Note: Chi-square statistics are in parenthesis.

*p ≤ .10
**p ≤ .05
***p ≤ .01

Physical capital as measured by the logarithm of the cost of the most expensive equipment used by the worker is not associated with a promotion outcome. The probationary period and "job has no promotion opportunity" dummy variables are positively and negatively related to promotions as anticipated. The clerical occupation dummy has a strong positive influence on promotion likelihood.

The hypothesis that unionization reduces the likelihood of promotion is confirmed in the model parameter estimates. Perhaps the most glaring refutation of the hypotheses concerning the determinants of promotion is that establishment size was found to be negatively correlated with promotion probability. The a priori hypothesis was based on the reasoning that because of reliance on internal job ladders and since large firms are generally thought to have better jobs, and therefore attract better applicants, larger firms should be associated with more promotions. An explanation for the contrary result might be that the structure of the hierarchy in a large firm is such that there are a larger number of (more) capable individuals vying for promotions, so the probability of any one individual being promoted is smaller. Also, it may be the case that more attractive total compensation packages in larger firms substitute for promotion opportunities.

Finally, table 4 shows that (1) promotions tend not to occur in the construction industry, and a (2) tight labor market ("difficult to find" variable) doesn't offset the probability of promotion.

Table 5 provides maximum likelihood estimates of promotion under the assumption that promotions result from a (Markovian) stochastic process. The parameter estimates in table 5 closely approximate the cross-sectional logit estimates provided in the previous table. Age at hire, (log of) establishment size, percentage unionization, and working in the construction industry are inversely related to promotion. The (logarithm of) hours spent on hiring, the (log of) time spent training the worker, and the percentage of workers under age 25 are positively related to the occurrence of a promotion. Years of education is positively related to the likelihood of promotion as hypothesized, but in these models, the coefficient is not quite statistically significant.

TABLE 5

DETERMINANTS OF PROMOTIONS ESTIMATED BY RATE WITH TIME INDEPENDENCE AND WITH TIME DEPENDENCE ASSUMPTIONS

Variables	Time Independence		Time Dependence	
Worker characteristics				
Age at hire	-.011***	(2.33)	-.011***	(2.38)
Male	-.004	(.00)	.001	(.00)
Prior relevant experience	-.001	(.94)	-.001	(.97)
Years of educ.	.024	(1.16)	.025	(1.19)
Years of vocational educ.	-.002	(.08)	-.001	(.00)
Characteristics of worker/ employer search				
Referred by friend, relative, or other employer	.046	(.66)	.054	(.78)
Subsidy received	-.171	(1.18)	-.176	(1.21)
Log hours spent on hiring	.086***	(3.26)	.081***	(3.04)
Characteristics of job				
Wage	.017	(1.36)	.018	(1.46)
Log training time	.064***	(2.97)	.063***	(2.96)
Training is general	-.076	(1.02)	-.072	(.96)
Log machine cost	.020	(.94)	.019	(.93)
Paperwork req'd to fire	-.082	(1.02)	-.081	(1.00)
Probationary period dummy	.421***	(4.48)	.417**	(4.44)
Clerical	.247***	(2.85)	.251***	(2.90)
No promotion opportunity	-1.045***	(5.38)	-1.021***	(5.25)
Characteristics of firm				
Log establishment size	-.050***	(2.00)	-.062***	(2.46)
Percentage union	-.004**	(2.74)	-.004***	(2.59)
Percentage under 25	.006***	(4.88)	.006***	(4.39)
Construction	-.281**	(1.88)	-.266*	(1.78)
Market characteristics				
Difficult to find	.005	(.54)	.043	(.48)
Time dependence (α)	X		.033***	(5.11)

Note: Asymptotic t-values are in parentheses.

*p ≤ .10
**p ≤ .05
***p ≤ .01

An interesting factor in analyzing the estimates in table 5 is the negative sign on the time dependence parameter and its statistical significance. The interpretation of this estimate is that the longer the tenure (recall that all observations have relatively short tenure), the smaller the instantaneous probability of going from the nonpromoted to the promoted state.

In summary, the empirical work confirmed most of the a priori hypotheses. Age and percentage unionization reduce the likelihood of a promotion. Education, informal referral mechanisms, hours invested in hiring and training are positively related to the probability of a promotion. Contrary to hypothesis, establishment size is inversely related to promotions.

The final section of this paper attempts to summarize the empirical results and offers conclusions relevant for policy purposes.

4. CONCLUSIONS AND POLICY IMPLICATIONS

The empirical work that has been presented in this report generally confirmed the hypotheses formulated on the bases of theory or prior research. But questions may be raised as to how all these findings relate to each other and what they imply for education and training policymakers and researchers. This chapter offers some conclusions that seem to flow from the empirical findings of the study and that begin to address policy concerns.

The starting point for these conclusions is the assumption that job outcomes can be measured and arrayed along a spectrum that probably resembles the bell-shaped curve of a normal probability density function as drawn in figure 4.1. It is left to the reader to imagine the appropriate metric for the job outcome spectrum. Some suggested ways of measuring outcomes include wages or earnings, productivity, occupational prestige, status, or satisfaction. At any rate, in this heuristic discussion, it is assumed that there is some metric and that positive outcomes occur in the upper tail of the spectrum, whereas negative outcomes are situated in the lower end of the spectrum. Of course, most job outcomes lie in the middle.

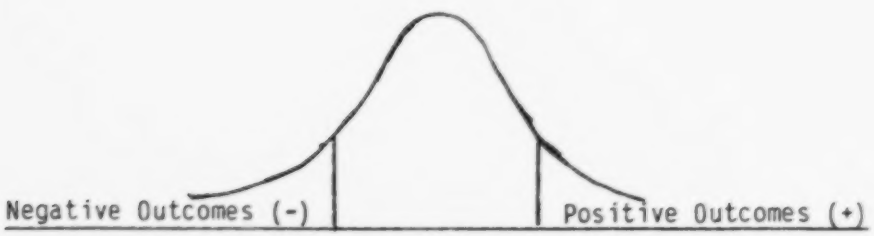

Figure 4.1. The job outcome spectrum

Job outcomes result from the unfolding of an employment relationship, which in this study has been thought of as a contract between principal and agent. In general, the employment relationship involves a period of training. After that period, the employment relationship may be stable or may result in separation. Figure 4.2 adds a representation of the employment relationship to the job outcome spectrum.

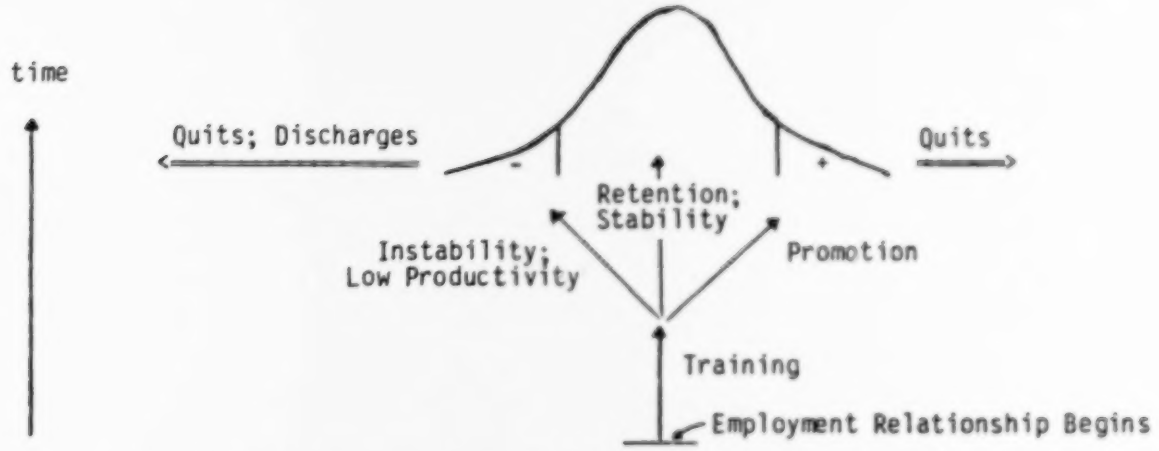

Figure 4.2. Employment relationship with the job outcome spectrum.

As shown in figure 4.2, promotions and stability tend to be related to favorable job outcomes and instability, and low productivity lead to unfavorable outcomes. Notice that unfavorable job outcomes may lead to quits or discharges, but also quits (generally to take better jobs) occur at the positive end of the job outcome spectrum as well.

In addition to training as a mediating process for job outcomes, job search also must be considered. This process is added in figure 4.3. Note that this figure is drawn to indicate that the period of job search for individuals with favorable job outcomes is shorter than the period for individuals with unfavorable outcomes. In fact, quite often, the period of unemployment is zero.

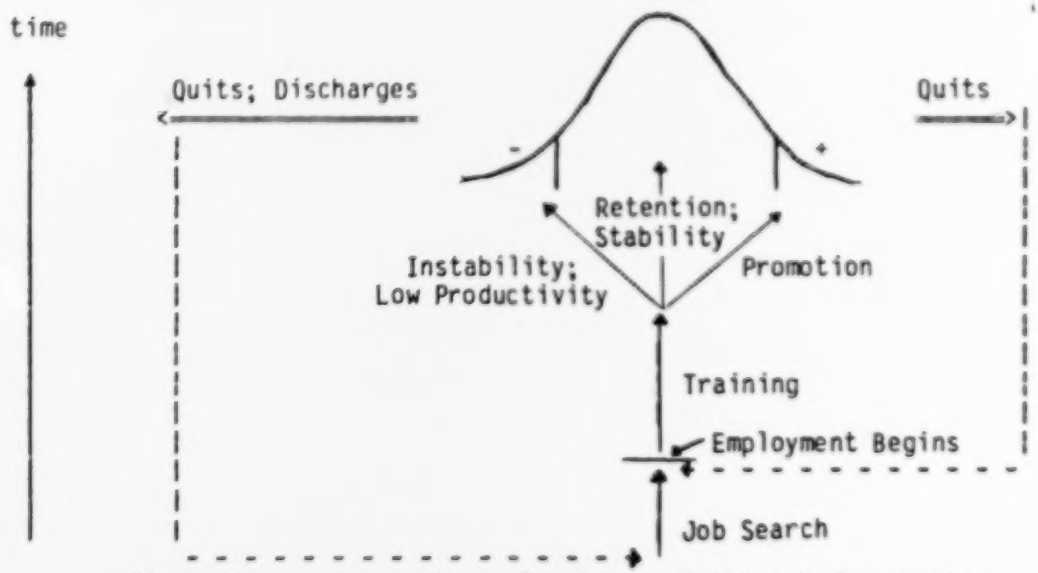

Figure 4.3 Job search, employment, and job outcome spectrum.

This heuristic representation of the employment relationship leads to four major conclusions of the study.

> Conclusion 1: On the job training is negatively related to quits and employer-initiated separations and positively related to promotions.

The employment outcome analyses indicate that the turnover and promotion effects of training augment increases in productivity resulting from OJT. The coefficients on the variable "length of time for typical worker to be trained in the job" were negative and statistically significant in the voluntary and involuntary separations models and positive and statistically significant in the promotions model. Thus employers and employees need to factor reduced turnover costs and increased promotion benefits into their training decisions. Furthermore, job searchers need to consider the amount of training afforded by various employment opportunities. Long-term career advancement and wage growth at a job with a significant training component may be more advantageous than alternative jobs with higher starting compensation but less training opportunity.

> Conclusion 2: Education does not seem to be related to employment separation but is positively related to promotion.

Employer and employee returns to education are not offset by greater turnover costs. They are effectively not altered at all by a consideration of separations. However, education strongly influences promotions. Results show the greater the educational attainment of an individual, the greater the likelihood of promotion, holding all other things equal. Promotions are typically, but not always characterized by wage growth. To the extent that promotions are valuable above and beyond wage growth, however, previous studies that have estimated the returns to education may have underestimated these benefits by neglecting an increased probability of promotion.

> Conclusion 3: Employment outcomes are more dependent on firm and job characteristics than on worker characteristics.

Key determinants of employment outcomes were the size of the firm, the probationary period characteristics of the job, industry, occupation, and level and amount of training on the job. This conclusion must be conditioned by recognition of the fact that the underlying data set contains only a few variables concerning the worker. That is, unmeasured (at least in this data set) worker characteristics may be important in determining employment outcomes.

> Conclusion 4: Individual job search and employer recruitment and selection behavior directs "better" workers (more human capital) into good jobs.

If job outcomes are generally correlated with human capital endowments, but outcomes and the provision of training that is so important to the likelihood of a successful outcome are job and firm dependent, there must be a mechanism that is directing "better" workers into "better" jobs. The evidence presented indicates that the search processes of workers and firms are precisely that mechanism. Informal referrals result in lower quit rates, lower rates of involuntary separation, and higher promotion rates. The time and resources invested in the search process by employers is directly related to promotions and retention.

The heuristic model we end up with then is presented in figure 4.4. The work force is heterogeneous in its human capital composition. The hiring processes, comprised of individual job search and employer recruitment and selection processes, result in a sorting of workers into jobs and firms. The training policies and characteristics of those jobs and firms tend to determine the outcomes of the employment relationships that are formed. Note that in figure 4.4, training is directly related to job outcome.

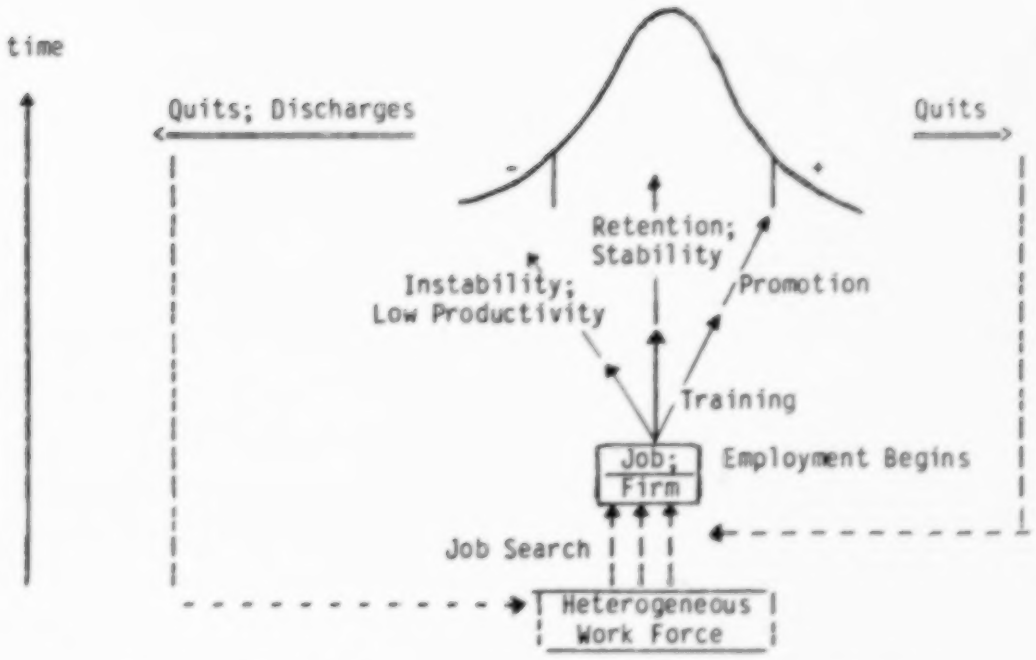

Figure 4.4. Job search, employment, and job outcome processes implied by the research

All in all, the findings of the study seem to highlight supply-side interventions. The work force is heterogeneous with respect to its human capital characteristics, so education and training policymakers concerned with the lower end of the distribution or with young people first entering the labor market are appropriately directed to programs that result in the enhancement of human capital, such as basic and employability skill development. On the job training is an important contributor to human capital as well; so, training subsidies may be indicated.

Finally, job search and employer recruitment and selection mechanisms seem to explain a considerable share of the labor market sorting that exists; so, policy emphasis should be placed on provision of job search skills for youth as well.

REFERENCES

Arrow, Kenneth J. "Higher Education as a Filter." Journal of Public Economics 2, no. 3 (1973): 193-216.

Becker, Gary S. Human Capital. 2d ed. Chicago: University of Chicago Press, 1975.

Bishop, John. "Productivity Growth and Turnover." In Subsidizing On-the-Job Training, edited by John Bishop, pp. 161-196. Columbus, OH: National Center for Research in Vocational Education, The Ohio State University, 1982.

———. The Social Payoff from Occupationally Specific Training: The Employer's Point of View. Columbus, OH: The National Center for Research in Vocational Education, The Ohio State University, 1983.

———. Hiring and Training Workers. Columbus, OH: The National Center for Research in Vocational Education, The Ohio State University, 1984.

Bishop, John H., and Kang, Suk. "Why Do Employers Underinvest in On-the-Job Training?" In Hiring and Training Workers, edited by John Bishop, pp. 59-105. Columbus OH: The National Center for Research in Vocational Education, The Ohio State University, 1984.

Burdett, Kenneth. "Theory of Employee Search and Quit Rates." American Economic Review 68 (March 1978): 212-20.

Burdett, Kenneth, and Mortensen, Dale T. "Search, Layoffs, and Labor Market Equilibrium" Journal of Political Economy 88, no. 4 (1980): 652-672.

Burton, John F., and Parker, John E. "Interindustry Variations in Voluntary Labor Mobility." Industrial and Labor Relations Review 22 (January 1969): 199-216.

Cho, Woo. "The Job Search Behavior of Employed Youth," September 1982, unpublished manuscript.

Doeringer, Peter B., and Piore, Michael J. Internal Labor Markets and Manpower Analysis. Lexington, MA: D.C. Heath and Company, 1971.

Feller, William. An Introduction to Probability Theory and its Applications, vol. 1, 3rd ed. New York, NY: John Wiley and Sons, 1968.

Flinn, Christopher J., and Heckman, James J. "Are Unemployment and Out of the Labor Force Behaviorally Distinct Labor Force States?" Journal of Labor Economics 1 (January 1983): 28-42.

Freeman, Richard B. "The Exit-Voice Tradeoff in the Labor Market: Unionism, Job Tenure, Quitism and Separations." Quarterly Journal of Economics (June 1980).

Hashimoto, Masanori. "Firm-Specific Human Capital as a Shared Investment." American Economic Review 71 (June 1981): 475-482.

Hashimoto, Masanori, and Yu, Ben T. "Specific Capital, Employment Contracts, and Wage Rigidity." Bell Journal of Economics 11 (Autumn 1980): 536-549.

Hollenbeck, Kevin and Mahle, Stephen. Firm Behavior in Making Hiring, Retention, and Promotion Decisions for Low Wage Workers. Columbus OH: The National Center for Research in Vocational Education, The Ohio State University, 1984.

Hollenbeck, Kevin, and Smith, Bruce. The Influence of Applicants' Education and Skills on Employability Assessments by Employer. Columbus, OH: The National Center for Research in Vocational Education, The Ohio State University, 1984.

Johnson, William R. "A Theory of Job Shopping." Quarterly Journal of Economics 92 (May 1978): 261-277.

Jovanovic, Boyan "Job Matching and the Theory of Turnover." Journal of Political Economy 87, no. 5 (October 1979): 972-990.

_____. "Matching, Turnover, and Unemployment." Journal of Political Economy 92, no. 1 (February 1984): 108-122.

Lippman, Steven A., and McCall, John J. "The Economics of Job Search: A Survey." Economic Inquiry 14 (June 1976a): 155-89.

_____. "The Economics of Job Search: A Survey." Economic Inquiry 14 (September 1976b): 347-68.

_____. "The Economics of Belated Information." International Economic Review 22, no. 1 (February 1981): 135-146.

McCall, Brian P., and McCall, John J. "Systematic Search, Belated Information, and the Gittins' Index." Economic Letters 8 (1981): 327-335.

Meitzen, Mark E. "Empirical Analysis of the Rate of Worker Separation" in Subsidizing On-the-Job Training, edited by John Bishop. Columbus, OH: National Center for Research in Vocational Education, The Ohio State University, 1982.

Mincer, Jacob. Schooling, Experience, and Earnings. New York: Columbia University Press, 1974.

Mincer, Jacob, and Jovanovic, Boyan. "Labor Mobility and Wages." Studies in Labor Markets. New York: National Bureau of Economic Research, 1981.

Nelson, Paul "Information and Consumer Behavior." Journal of Political Economy 78 (April 1970): 311-329.

Noble, Ben. Applied Linear Algebra. Englewood Cliffs, NJ: Prentice Hall, 1969.

Oi, Walter Y. "Labor as a Quasi-Fixed Factor." Journal of Political Economy 70 (1962): 538-555.

Parsons, Donald O. "Models of Labor Market Turnover: A Theoretical and Empirical Survey." In Research in Labor Economics 1, edited by R. Ehrenberg. Greenwich, CT: J.A.I. Press, 1977.

_____. "Quit Rates Over Time: A Search and Information Approach." American Economic Review 63 (June 1973): 390-401.

_____. "Specific Human Capital: An Application to Quit Rates and Layoff Rates." Journal of Political Economy 80, no. 6, (December 1972): 1120-1143.

_____. "The Employment Relationship: Job Attachments Work Effort, and The Nature of Contracts," (1984), Unpublished manuscript.

Rosen, Harvey S. "Taxation and On-the-Job Training Decisions." The Review of Economics and Statistics 44, no. 3 (August 1982): 442-449.

Salop, Steven. "Systematic Job Search and Unemployment." Review of Economic Studies (April 1973): 191-210.

Stoikov, V., and Raimon, R.L. "Determinants of the Differences in the Quit Rate Among Industries." American Economic Review 58 (December 1968): 1283-1298.

Thurow, Lester C. "Measuring the Economic Benefits of Education." In Higher Education and the Labor Market, edited by Margaret S. Gordon, pp. 373-418. Berkeley, CA: The Carnegie Commission on Higher Education, 1974.

Tuma, Nancy B. "Invoking Rate." Stanford Research Institute, Center for the Study of Welfare Policy. Menlo Park, CA: Stanford Research Institute, 1980.

Weitzman, Martin L. "Optimal Search for the Best Alternative." Econometrica 47 (1979): 641-654.

Wise, David A. "Personal Attributes, Job Performance, and Probability of Promotion." Econometrica 43 (1975): 913-931.